AIRBAG APPARATUS FOR VEHICLE

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to an airbag apparatus for a vehicle.

Description of the Prior Art

A vehicle such as an automobile is provided with an airbag apparatus as safety means in an emergency.

In this airbag apparatus, when a predetermined or higher load acts on a vehicle body, the airbag body which is accommodated with a folded state in a housing disposed inside the instrument panel is inflated toward an occupant compartment inner side by the pressured gas from an inflator, and receives an occupant seated at a predetermined position, and then protects the occupant from collision with the instrument panel.

The airbag body is adopted to push an airbag lid which is provided on a fixing portion by a fragile line formed on an instrument panel and the like, and to open the airbag lid by breaking the fragile line, to form an inflation opening, and to be inflated toward an occupant compartment inner side from the inflation opening. It is preferable for the fixing portion to be fixed without being moved when the airbag is inflated, but the fixing portion includes small deformation when the airbag is expanded because the inflation pressure at the time of expanding the airbag is very large.

Such an airbag lid is provided with a door for holding disposed in the back surface of the airbag lid in order to help the opening of the airbag lid.

The holding door is attached to the instrument panel in the

vicinity of the airbag lid. The installation of the holding door to the airbag lid is performed such that a boss projected from the back surface of the airbag lid is passed through a hole formed on the holding door, and is fixed by thermal caulking.

The holding door is provided with a longitudinal bead (For example, reference to Japanese Patent Laid-Open 2002-220018).

However, the airbag apparatus for a vehicle described in the Japanese Patent Laid-Open 2002-220018 had a possibility that the portion between the holding door and the airbag lid is destroyed in the vicinity of a hinge portion when the airbag is expanded.

Furthermore, in case of providing the holding door on the back surface of the airbag lid, if the edge portion of the holding door is located in the vicinity of the fragile line, the fragile line is broken by the shearing force when the airbag body is expanded. If the fragile line is broken by the shearing force, the fragile line may not be clearly broken along the line, and there is a possibility that a fragment is generated in the portion where the fragile line is broken aside from the line. It has been known that such a fragment tends to be generated in the corner portion of the airbag lid.

Consequently, there has been proposed an airbag apparatus which includes a generally mountain shaped cut off on the holding door so as to bend the corner portion of the holding door first when the airbag body is expanded, so that the shearing force acted on the corner portion of the fragile line is weakened, and the fragile line can be clearly broken (for example, reference to Japanese Patent Laid-Open 2001-315605). In this patent application, the airbag lid is adopted to open as an H shape by a fragile line of H shape. The corner portion of the holding

door is directly connected to the airbag lid.

However, the airbag apparatus described in the Japanese Patent Laid-Open 2001-315605 is for opening the airbag lid as the H shape by the fragile line of the H shape, so if the airbag apparatus is applied to an airbag lid which is opened as a U shape or a square shape by the fragile line of the U shape or the square shape, the airbag apparatus may not be operated well.

In other words, if the airbag apparatus is opened as the H shape, since two airbag lids are opened as a gatefold, the two lids are easy to be opened. Therefore the fragile line can be destroyed by effectively weakening the shearing force acted on the corner of the fragile line with the state that the corner portion of the holding door is bent. However, when an airbag lid is opened as a U shape or a square shape, the other portion of the airbag lid is the fixing portion of an instrument panel, so the lid is difficult to be opened than the H shaped airbag lid, and it is thought that the state of bending a corner portion of a holding door is not enough for breaking the U shaped fragile line and the square shape fragile line by effectively weakening the shearing force acted on the corner portion of the fragile line.

In the Japanese Patent Laid-Open 2001-315605, a corner portion of a holding door is directly connected to an airbag lid, but this structure disturbs the function for weakening a shearing force. Therefore, the airbag apparatus was hard to be used for the airbag lid of the U shape or the square shape, which includes the fixing portion of an instrument panel as the other portion.

SUMMARY OF THE INVENTION

It is, therefore, an object of the present invention to solve the above described problems and to provide an airbag apparatus for a vehicle which can prevent the damage between a holding door and an airbag lid when the airbag is expanded.

It is the other object of the present invention to solve the above described problems and to provide an airbag apparatus for a vehicle which can break a fragile line clearly when an airbag lid is opened as a U shape or a square shape.

In order to achieve the above described objects, according to a first embodiment of the present invention, an airbag apparatus for a vehicle comprises an airbag lid provided by a fragile line on a resin instrument panel and a door for holding disposed in the back surface of the airbag lid by fixing a boss projected from the back surface of the airbag lid. The holding door includes a door body portion positioned in the back surface of the airbag lid, an installation portion to the instrument panel disposed around the airbag lid, and a hinge portion disposed between the door body portion and the installation portion. The door body portion of the holding door includes a longitudinal bead extending from the hinge portion side to the leading end side of the door body portion and a lateral bead which is positioned between the hinge portion and an installation portion to the boss disposed in the vicinity of the hinge portion and is extended along the hinge portion, and the longitudinal bead and the lateral bead are constructed to be crossed.

According to the above described airbag apparatus for the vehicle, the strength of the longitudinal direction of the door body portion can be improved by the longitudinal bead. The strength of the lateral direction of the door body portion can be improved by the lateral bead.

The strengths of the longitudinal direction and the lateral direction of the door body portion are further enhanced by crossing the longitudinal bead and the lateral bead. Consequently, the damage between the holding door and the airbag lid when the airbag is expanded can be prevented. The strength in the vicinity of the hinge portion of the door body portion can be improved especially by crossing the longitudinal bead and the lateral bead in the vicinity of the hinge portion. Therefore, the damage in the vicinity of the hinge portion at the time of expanding the airbag can be prevented.

In an example, the airbag apparatus includes a plurality of longitudinal beads. The strength of the longitudinal direction of the door body portion is further enhanced by providing the plurality of longitudinal beads.

In the other example, the other lateral bead which is a parallel to the lateral bead is provided so as to construct a lattice form by the longitudinal beads and the lateral beads, and an installation portion to a boss is formed inside the lattice form portion. The strength of the door body portion is further enhanced by construing the longitudinal beads and the lateral beads to be the lattice form. By forming the installation portion to the boss inside the lattice form portion, an installation point is definitely provided in the portion where the strength is improved.

In an example, the holding door is a metal door, and by adopting the metal door as the holding door, the bead and boss hole are punched and formed all at once by press molding.

According to a second embodiment of the present invention, an airbag apparatus for a vehicle comprises an airbag lid zoned from a fixing portion by a U shaped fragile line or a square shaped fragile line

to a resin instrument panel, and is opened to the fixing portion by the break of the U shaped fragile line or the square shaped fragile line when an airbag body is expanded, and a door for holding disposed in the back surface of the airbag lid. The holding door includes a door body portion positioned in the back surface of the airbag lid, an installation portion to the fixing portion, and a hinge portion disposed between the door body portion and the installation portion. The spaces between the both sides of the airbag lid and the both sides of the door body portion are formed by adopting a smaller width dimension of the door body portion of the holding door than the width dimension of the airbag lid, and the spaces in the width direction between the both sides of the airbag lid and the both sides of the door body portion are constructed to be larger gradually toward the leading end portion side by cutting crosswise the corner portions of the door body portion.

According to the above described airbag for the vehicle, the width dimension of the door body portion of the holding door is adopted to be smaller than the width dimension of the airbag lid, and the spaces between the both sides of the airbag lid and the both sides of the door body portion are formed. Therefore, when the airbag body is expanded, the fragile line can be broken by a tension force. The corner portions of the door body portion are cut crosswise, and the spaces in the width direction between the both sides of the airbag lid and the both sides of the door body portion are constructed to be larger gradually toward the leading end side, so that the tension force acted on the corner portion of the airbag lid is set to be larger. As described above, the airbag apparatus for the vehicle can break the fragile line by effectively using the tension force even when the U shaped airbag lid or the square

shaped airbag lid which includes the fixing portion of the instrument panel as the other portion.

BRIEF DESCRIPTION OF THE DRAWINBGS

FIG. 1 is a lateral cross-section view of an airbag apparatus according to the first embodiment of the present invention.

FIG. 2 is a plane view of a holding door in FIG. 1.

FIG. 3 is a perspective view of the holding door in FIG. 1.

FIGs. 4A, 4B, and 4C are actuation views at the time of expanding an airbag when a longitudinal bead is provided.

FIGs. 5A, 5B, and 5C are actuation views at the time of expanding an airbag when a longitudinal bead is not provided.

FIGs. 6A, 6B, and 6C are actuation views at the time of expanding an airbag when a lateral bead is provided.

FIGs. 7A, 7B, and 7C are actuation views at the time of expanding an airbag when a lateral bead is not provided.

FIG. 8 is a plane view of a holding door of an airbag apparatus according to the second embodiment of the present invention.

FIG. 9 is a cross section view of A-A portion in FIG. 8 showing the state that a holding door destroys a fragile line by a tension force.

FIG. 10 is a cross section view of B-B portion in FIG. 8 showing the state that a holding door destroys a fragile line by a shearing force.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Several embodiments of the present invention will be described below with reference to the accompanying views.

(First invention)

FIGs. 1 to 7C show an airbag apparatus according to the first

embodiment of the present invention which is provided in a vehicle such as an automobile as safety means in an emergency.

The airbag apparatus 1 is provided in an occupant seat side of the portion of an instrument panel 2 which is positioned below a windshield of an automobile.

The above described instrument panel 2 is made of resin, and also it is a hard panel formed by a core in which the resin layer is attached. The instrument panel 2 generally has a size extending from a driver seat to an occupant seat, but there is an instrument panel portion 2 disposed only in an occupant seat.

The instrument panel 2 includes the instrument panel portion 2 in below.

A square shaped fragile line 3 is formed to the resin instrument panel 2, and a fixing portion 4 and an airbag lid 5 are separated by the fragile line 3. The airbag lid 5 is opened to the fixing portion 4 by breaking the square shaped fragile line 3 when an airbag body 6 is expanded, and forms an inflation opening of the airbag body 6.

The fragile line 3 is formed on the back surface of the instrument panel 2, and it is constructed that the airbag lid 5 can not be seen from the surface side of the instrument panel 2.

A reinforcement member 7 is disposed in the peripheral border of the inflation opening in which the airbag lid 5 in the instrument panel 2 is opened. If the fragile line 3 is formed as a square shape, the airbag lid 5 can be opened without using a hinge.

A door for holding 8 is disposed in the back surface of the airbag lid 5. The holding door 8 includes a door body portion 9 which is positioned in the back surface of the airbag lid 5, an installation portion

10 which is disposed in the reinforcement member 7 provided in the vicinity of the airbag lid 5, and a hinge portion 11 which is provided between the door body portion 9 and the installation portion 10. The holding door 8 is constructed separately from the reinforcement member 7. The door body portion 9 may be supported by a reinforcement member 7 with superimposing at least part of the peripheral border of the door body portion 9 onto the reinforcement member 7, so that the deformation of the airbag lid 5 may be prevented.

A plurality of pairs of bosses 15 is projected from the back surface of the airbag lid 5. The door body portion 9 is formed with a plurality of pairs of holes 16 (refer to FIG. 2) which passed through the bosses 15. The holding door 8 is disposed in the back surface of the airbag lid 5 by fixing the bosses 15 with thermal caulking after passing through the holes 16. The boss 15 includes a longitudinal rib like shape extending only a required length toward the frontward and backward direction of a vehicle 17. The hole 16 includes a slit extending only a required length toward the frontward and backward direction of the vehicle 17. A plurality of pairs of bosses 18 is also projected from the back surface of the fixing portion 4. The reinforcement member 7 is formed with a plurality of pairs of holes (not shown) which passed through the boss 18. The reinforcement member 7 is disposed in the back surface of the fixing portion 4 by fixing the boss 18 with the thermal caulking after passing through the hole.

A leg portion 20 of frame shape is formed in around the fragile line 3 of the reinforcement member 7. The installation portion 10 of the holding door 8 is fixed to the leg portion 20 by spot welding. The installation portion 10 is disposed in the front portion of the front or

back direction of the vehicle 17 of the leg portion 20.

The airbag apparatus 1 comprises an airbag module 26 including a hook for disposing a lid 25 which is capable of inserting and engaging to a hole for engaging a hook formed on the leg portion 20 of the reinforcement member 7. The airbag module 26 is arranged in the leg portion 20 of the reinforcement member 7 through the hook 25, so that the reaction force when the airbag body 6 is expanded does not directly act on the instrument panel 2.

The airbag module 26 comprises an inflator containing portion 28 capable of containing a cylindrical inflator 27 which ejects pressured gas. This inflator containing portion 28 is fastened and fixed to a vehicle side member such as a steering support member (not shown) by using a fastening member 29 such as a bolt.

The airbag module 26 comprises an airbag body containing portion 30 for containing the folded state airbag body 6 which is inflated and expanded by the pressured gas ejected from the inflator 27.

In the first embodiment of the present invention, a longitudinal bead 21 extending from the hinge portion 11 side to the leading end side of the door body portion 9 is provided in the door body portion 9 of the holding door 8. A lateral bead 22 positioned between the hinge portion 11 and the installation portion (hole16) to the boss 15 disposed in the vicinity of the hinge portion 11, and extending along the hinge portion 11 is also provided in the door body portion 9. The longitudinal bead 21 and the lateral bead 22 are constructed to be crossed in the vicinity of the hinge portion 11.

Moreover, in one embodiment, a plurality of longitudinal beads 21 is provided.

Furthermore, another lateral bead 23 which is a parallel to the lateral bead 22 is provided, so that the longitudinal bead 21, lateral beads 22 and 23 are constructed to be almost in a lattice form, and the installation potion (hole 16) to the boss 15 is formed inside the lattice form.

A resin door can be used for the holding door 8, but it is preferable for the holding door 8 to use a metal door. Reference numeral 35 denotes the direction of vehicle width.

Next, the function of the above described first embodiment of the present invention will be described.

When the inflator 27 is activated, the pressured gas from the inflator 27 is ejected, and is injected into the airbag body 6.

The airbag body 6 is inflated with the injection of the gas, and the square shaped fragile line 3 is broken by the pressure of the inflation, and then the airbag lid 5 is opened to the fixing portion 4 and the inflation opening is formed, and at the same time, the airbag body 6 is inflated toward the oblique backward of a vehicle (an occupant compartment inner side) from the inflation opening. Therefore, the airbag body 6 receives a head and the like of an occupant in an occupant seat side seated in a predetermined position, and protects the head and the like from contacting to the instrument panel 2.

According to the first embodiment of the present invention, the strength of the longitudinal direction (frontward and backward direction of vehicle 17) of the door body portion 9 can be improved by the longitudinal bead 21. If the strength of the longitudinal direction of the door body portion 9 is improved, as shown in FIGs. 4A to 4C, when the airbag body 6 is expanded, the curvature deformation in the longitudinal

direction of the airbag lid 5 and the door body portion 9 is suppressed to small deformation, so the airbag lid 5 can be opened with leaving flexibility in the hinge portion 11. On the other hand, if the longitudinal bead 21 is not disposed, as shown in FIGs. 5A to 5C, the curvature deformation in the longitudinal direction of the airbag lid 5 and door body portion 9 becomes large when the airbag body 6 is expanded, so the hinge portion 11 is extended for full-length, and the portion between the airbag lid 5 and the door body portion 9 may be destroyed (reference to FIG. 5C).

The strength of lateral direction (the direction of vehicle width 35) can be improved by the lateral bead 22. If the strength of the lateral direction of the door body portion 9 is improved, as shown in FIGs. 6A to 6C, when the airbag body 6 is expanded, the airbag lid 5 can be opened with the state that the curvature deformation in the lateral direction of the airbag lid 5 and the door body portion 9 is suppressed to small deformation.

On the contrary, if the lateral bead 22 is not provided, as shown in FIGs. 7A to 7C, the airbag lid 5 is opened with the state that the curvature deformation in the lateral direction of the airbag lid 5 and the door body portion 9 is large, and the portion between the airbag lid 5 and the door body portion 9 may be destroyed (reference to FIG. 7C).

Moreover, the strengths of the longitudinal direction and the lateral direction of the door body portion 9 can be further enhanced by crossing the longitudinal bead 21 and the lateral bead 22. Therefore, the damage between the holding door 8 and the airbag lid 5 at the time of expanding the airbag body 6 can be prevented (reference to FIGs. 4C and 6C).

The strength in the vicinity of the hinge portion 11 of the door body portion 9 can be selectively improved especially by crossing the lateral bead 21 and the longitudinal bead 23 in the vicinity of the hinge portion 11. Therefore, the damage in the vicinity of the hinge portion 11 at the time of expanding the airbag body 6 can be prevented (reference to FIG. 4C).

The strength of the longitudinal direction of the door body portion 9 can be further enhanced by providing a plurality of longitudinal beads 21.

Furthermore, the strength of the door body portion 9 can be further enhanced by constricting the longitudinal beads 21 and the lateral beads 23 and 23 to be the lattice form. An installation point is definitely disposed in the portion, where the strength is enhanced, by forming the installation portion (hole 16) to the boss 15 inside the lattice form.

The metal door is adopted as the holding door 8, so that the hole 16 for the bead and the boss 15 is punched and formed all at once by press molding.

FIGs. 8 to 10 are for showing the second embodiment of the present invention. The basic structure of the airbag apparatus 1 is same as the first embodiment, so the explanation of the first embodiment is given to the second embodiment. In the first embodiment, the fragile line 3 is adopted as the square shape, but the fragile line 3 can be a U shape or a square shape. When the fragile line 3 is adopted as the U shape, the airbag lid 5 is opened by including a hinge in the disconnecting portion of the U shaped fragile line 3. On the other hand, if the fragile line 3 is adopted as the square shape, the

airbag lid 5 can be opened without including a hinge.

In the second embodiment, as shown in FIG. 8, adopting the direction of vehicle width as a standard, the width dimension of the door body portion 9 of the holding door 8 is adopted to be smaller than the width dimension of the airbag lid 5, so spaces 36 are formed between the both sides of the airbag lid 5 and the both sides of the door body portion 9.

Moreover, the corner portions of the door body portion 9 are cut substantially crosswise (cut line 38), so the spaces 36 in the width direction between the both sides of the airbag lid 5 and the both sides of the door body portion 9 are constructed to be larger toward the leading end side.

Next, the function of the second embodiment will be described.

The basic actuation of the airbag apparatus 1 is same as the first embodiment, so the explanation of the first embodiment is given to the second embodiment.

According to the second embodiment of the present invention, the width dimension of the door body portion 9 of the holding door 8 is adopted to be smaller than the width dimension of the airbag lid 5, and the spaces 36 are formed between the both sides of the airbag lid 5 and the both sides of the door body portion 9, so the fragile line 3 can be broken by the tension force when the airbag body 6 is expanded.

In other words, as shown in FIG. 9, the edge portion of the door body portion 9 of the holding door 8 presses the position where is apart from the fragile line 3, so the tension force acts on the fragile line 3, and then the fragile line 3 is broken by the tension force. On the other hand, as shown in FIG. 10, if the edge portion of the door body portion 9 of the

holding door 8 presses the position where is close to the fragile line 3, the shearing force acts on the fragile line 3, and the fragile line 3 is broken by the shearing force.

The central portion of the direction of vehicle width 35 in the leading end of the door body portion 9 of the holding door 8 is broken by the above mentioned shearing force, but it is constructed intentionally so as to set a splitting origin, so actually, this construction does not affect the break of the fragile line 3.

Moreover, especially, the corner portions of the door body portion 9 of the holding door 8 are cut crosswise, the spaces in the direction of width between the both sides of airbag lid 5 and the both sides of the door body portion 9 are constructed to be a larger gradually toward the leading end, so the tension force acted on the corner of the airbag lid 5 is adopted to be larger.

As described above, if the U shaped airbag lid 5 or the square shaped airbag lid 5 which includes the fixing portion 4 of the instrument panel 2 as the other portion, the fragile line 3 can be clearly broken by effectively using the tension force.